

Forces of modernization and the welfare of rural households: a saga of a village in Central Luzon, 1977-2013

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This study aims to give a detailed account of how household sources of livelihood, income, and poverty change under the pressure of four modernizing forces: (1) population pressure on closed land frontier; (2) implementation of land reform; (3) expansion of public infrastructures such as irrigation systems, roads, and schools; and (4) growing urban influences accelerated by improvements in transportation and telecommunication systems. This study was conducted in a village in Central Luzon where recurrent household surveys were done for 36 years from 1977 to 2013 encompassing the period of dramatic diffusion of modern rice technology. The major finding is that the interaction between the four modernizing forces and the diffusion of modern rice technology resulted in major economic and social changes that led to a rise in household income and prevented poverty from increasing. This study provides evidence contrary to the popular belief that the spread of modern agricultural technology and the encroachment of market activities into rural villages are harmful to the economic welfare of the rural Filipino people.

JEL classification: O15, Q12, Q15

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1. Introduction

There is a widespread belief that the spread of new agricultural technology and penetration of market activities in rural villages tend to destroy existing economic institutions based on the principle of mutual help and income sharing, leading to unequal distribution of gains and further impoverishment of the rural poor. In fact, during the heydays of the Green Revolution (GR) in Asia, concerns have been raised that the new rice technology tends to confer more benefits to large farmers compared with small farmers. Also, there was an observed acceleration in the spread of labor-saving technologies during the GR [David and Otsuka 1994],

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leading to further suspicion that the new rice technology has the effect of destroying labor employment opportunities for the landless poor. This suspicion persists despite studies showing that the new rice technology increases the demand for labor (in particular, hired labor for crop care activities and harvesting and threshing).

In more recent years, when the “steam” of GR is believed to have run out, rural villages are increasingly confronted with the pressure of commercialization penetrating the very core of rural household livelihood activities. Indeed, case studies in Asia have shown that rural households are increasingly getting more engaged in more commercialized nonfarm activities and getting away from rice farming [Estudillo and Otsuka 2016]. This is because of the decline in the size of operational landholdings due to closed land frontier and partible inheritance system, stagnation in rice yield, long-term decline in rice prices, and the increasing profitability of nonfarm activities relative to rice farming.

Importantly, in the case of the Philippines, beneficiaries of land reform experienced an increase in farm income because of the GR and the implementation of land reform that converted share tenants into either owner-cultivators or leaseholders with land rent prescribed by law set lower than the market rate. Pieces of evidence show that beneficiaries of land reform during the GR used their farm income to invest in the schooling of their children [Estudillo, Sawada, and Otsuka 2009], who, upon completing higher levels of schooling, migrated out of the villages to local towns, cities, and overseas while sending remittances back to the villages. As a result, the increase in nonfarm income has become the major source of household income growth and poverty reduction [Estudillo, Sawada, and Otsuka 2008]. Despite these shreds of evidence, however, the belief that urban-based market activities are not beneficial to the rural poor has persisted.

This research explores whether the new rice technology and market forces improved the well-being of the poor rural Filipinos. This paper gives a microscopic view of the dynamic processes underlying the changes in household sources of livelihood, landholdings and their distribution, and poverty in a Central Luzon village (henceforth referred to as the CLV) for nearly four decades encompassing the period of dramatic diffusion of modern rice technology under the pressure of four forces of modernization: (1) population pressure on a closed land frontier; (2) implementation of land reform; (3) expansion of public infrastructures such as irrigation systems, roads, and schools; and (4) growing urban influences accelerated by improvements in transportation and telecommunication systems. The main finding is that the interaction between the new rice technology and these modernizing forces did not necessarily lead to the impoverishment of rural households, as household income in the CLV did not decrease and poverty did not increase. Thus, contrary to the traditional belief that the new rice technology and commercialization are “evil twins”, findings in the CLV indicate that, on the contrary, the interaction of modern rice technology with forces of commercialization are “combined friendly forces” that create economic benefits to the larger segment of the rural Filipino community.

This paper has four remaining sections. Section 2 describes the location of the CLV and enumerates the waves of surveys undertaken there. Section 3 presents an account of the evolution of the four modernizing forces and the spread of new rice technology. Section 4 explores how household sources of livelihood have changed and how poverty has declined over time. Finally, Section 5 is the summary and conclusion.

2. Approach to the village

2.1 Early settlement

The CLV is one of the *barangays* (local name for villages) in a city in the province of Nueva Ecija in the Central Luzon Region (the “rice bowl” of the Philippines). It is a small village known for its vast farmland, traditionally planted with rice in the wet season and with fruits and vegetables during the dry season. This village was randomly selected from an extensive survey of 50 villages, representing irrigated and rainfed lowland rice production environments in northern, central, and southern Luzon, as well as Panay Island [David and Otsuka 1994:52]. While the CLV is a representative of a typical lowland favorably rainfed in 1985, it was no longer the case in the last survey in 2013 with the opening of the CASECNAN irrigation system that started servicing the village in 2008.

The CLV was originally a forested area that the government opened up as a homestead and that attracted early settlers. As the CLV developed, it attracted landless workers to the village because of the high demand for labor in rice farming and the propagation of high-value crops and livestock. Landless workers were reported to have been present in the area even before 1939. In 1977, about 26 percent of the household heads in this village were landless workers [Dozina 1978].

During the early stages of CLV’s development, most of the households were formed through intermarriage among local inhabitants. Dozina [1978] found that only 30 percent of the households interviewed in 1977 were formed through migration. The rest were formed through intermarriages of the local people. However, between 1992 and 2013, the total number of households who are immigrants to the CLV increased over time. A substantial number of immigrant households were landless workers, adding up to the burgeoning number of resident landless households in the village. The number of migrant households rose from 29 in 2004 to 70 in 2013; in both years, landless households made up 83 percent of all migrant households, and farmer-migrant households made up the remaining 17 percent (Table 1). The landless workers’ major reason for migrating is to look for economic opportunities. The farmers’ major reasons for migrating into the CLV are related to ownership of land (through inheritance or purchase) or marriage.

TABLE 1. Number of migrant households in the Central Luzon Village, 1992-2013

Type of household	No. of migrant households		
	1992	2004	2013
No. of households	230	381	509
No. of migrants [*]	31 (100)	29 (100)	70 (100)
Farmers	13 (42)	5 (17)	12 (17)
Landless	18 (58)	24 (83)	58 (83)

* Numbers in parenthesis are proportions to total migrants.

2.2 Waves of surveys

For 36 years, numerous household surveys were conducted in the CLV. The very first one was conducted by Geronimo E. Dozina in 1977 in line with the International Rice Research Institute (IRRI) Agricultural Economics Department's research project on agrarian adaptation to demographic and technological changes [Dozina 1978]. We used Dozina's data as our baseline information. Dozina conducted a complete enumeration of households in the CLV between August and November 1977, covering the crop year 1976-77 (wet season crop in 1976 and dry season crop in 1977).

IRRI made a follow-up survey in 1985 (under the leadership of Cristina C. David and Keiji Otsuka) [David and Otsuka 1994] and again in 1992 and 1997 (under the leadership of the late Mahabub Hossain). The IRRI surveys were aimed at assessing the impact of modern rice technology on household income distribution. The 2004 and 2008 surveys were conducted by Jonna P. Estudillo and Keiji Otsuka (Estudillo et al. [2008]; Estudillo et al. [2014]) with generous funding from the Foundation for Advanced Studies on International Development (FASID) and the National Graduate Institute for Policy Studies (GRIPS), which are both located in Tokyo, Japan. The Estudillo-Otsuka surveys explored how the adoption of modern rice technology has impacted household investment decisions on human capital, including children's schooling and migration to local towns, cities, and overseas. The latest survey was in 2013, conducted by the two authors of this paper with generous funding from the GRIPS Emerging State Project JSPS KAKENHI Grant Number 25101002 under the leadership of Tetsushi Sonobe of GRIPS. This latest survey was simply an update of the IRRI past surveys to identify sources of household income growth and assess changes in poverty and household income inequality in the village.¹

Our analysis in this paper is based mainly on household surveys in 1977, 1992, 2004, and 2013. We have chosen those years because those surveys were conducted for all households living in the CLV (i.e., complete enumeration survey). The 1985

¹ Supplemental surveys include those undertaken by Quisumbing [1994] on land inheritance and schooling decisions; by Nagarajan, Quisumbing, and Otsuka [1991] on credit contract; and by Hayami and Otsuka [1993] on land contracts.

survey was conducted for only a representative sample set of households. While complete enumeration was undertaken in 1997 and 2008, we believe that those years are not normal survey years. The Asian financial crisis was in 1998, which is a year immediately following the 1997 survey. CASECNAN started its irrigation service to the CLV in 2008 on a limited scale and the Asian rice crisis took place in 2008.

2.3 Number of households

In 1977, only 118 households lived in the CLV. This number increased to 230 in 1992, 381 in 2004, and 509 in 2013 (Table 2). The total village population rose from 649 people in 1977 to 2,925 people in 2013. This means that the village population was rising by 4.2 percent annually, which was higher than the national average of 1.6-2.8 percent between 1977 and 2013. While we cannot identify the contribution of natural increase and in-migration to total population increase, it is reasonable to speculate that in-migration has the greater contribution, considering that urban centers are fairly accessible to the CLV. Also, employment opportunities in agriculture within the village have increased due to the spread of modern rice technology, the development of irrigation, and the increasing popularity of the propagation of high-value crops, livestock, and poultry during the slack season.

TABLE 2. Distribution of households, by household head occupation, in the Central Luzon Village, 1977-2013

Occupational category of household heads	1977		1992		2004		2013	
	No.	%	No.	%	No.	%	No.	%
Farmers	88	74	134	58	129	34	142	28
Landless workers	30	26	96	42	252	66	367	72
a. Agricultural landless	15	13			150	39	164	32
i. Daily wage workers					92	24	87	17
ii. <i>Porcientuhan</i>					58	15	77	15
b. Non-agricultural landless	15	13			102	27	203	40
Total	118	100	230	100	381	100	509	100

We classified households into two major categories: (1) farmer and (2) landless households. We classified households based on the main occupation of the household heads, who are predominantly the male spouse. By farmer households, we mean the head is a rice farmer because rice is the main crop. Rice farmers include owner cultivators, leasehold tenants, and share tenants. Landless households are further categorized into three major groups: (1) daily wage workers, (2) *porcientuhan* workers, and (3) non-agricultural workers.

Daily wage workers are those who eke out their living from daily wage work in transplanting and weeding. This group is observed to be the poorest in the CLV. *Porcientuhan* workers are engaged in a labor contract called the “*porcientuhan* contract”, which commonly lasts for two years. Under this contract, the laborer receives 10 percent of the gross rice production as payment for land preparation and crop care activities such as fertilizer and insecticide application and weeding. Non-agricultural workers are those who are employed in wage work in the formal sector (private and public) and informal sector (transport, retail trade, services, etc.) and those who are self-employed.

In 1977, 74 percent of households in the CLV were headed by rice farmers, and the remaining were headed by agricultural landless workers (13 percent) and non-agricultural workers (13 percent) (Table 2). There was a remarkable decrease in the proportion of households headed by rice farmers from 74 percent in 1977 to 28 percent in 2013. This is because of the increasing scarcity of rice farms due to high population growth in a regime of closed land frontier. While there was no formal account of when forestlands were exhausted, we speculate that the land frontier was closed in the early 1950s. Thus, it is not surprising that a majority of households in the CLV in 2013 were headed by non-agricultural workers (40 percent), daily wage workers in agriculture (17 percent), and *porcientuhan* workers (15 percent) (Table 2). Given that rice farming has become a less important source of livelihood in the CLV, we can reasonably speculate that the impact of modern rice technology on household income growth, poverty, and inequality in the CLV is much less in more recent years compared with the first survey in 1977.

3. Modernizing forces and new rice technology

Here we trace one by one the various influences of the four forces of modernization on the socio-economic fabric of the CLV. The four modernizing forces are (1) population pressure on a closed land frontier; (2) implementation of land reform; (3) expansion of public infrastructures such as irrigation systems, market infrastructure (roads and bridge), and schools; and (4) growing urban influences accelerated by improvements in transportation and telecommunication systems. Incidentally, the emergence of those forces coincided with the spread of the new rice technology and thus we also identify various forms of interaction between those modernizing forces and the new rice technology.

3.1 Population pressure

Population pressure means a high growth rate of the labor force on a closed land frontier. Population pressure results in a decline in farm size, which causes poverty because the farmland is the main source of household income in the early stage of development (Hayami and Kikuchi [2000]; Estudillo and Otsuka [1999]).

Table 3 shows various indicators of population pressure in the CLV (man/land ratio, land/family ratio, land/farmer household ratio, land/person ratio). All of those show a large decline from 1977 to 2013, indicating that population pressure was strong in the village. Also, there appears to be a conversion of rice farms into residential and other uses, importantly irrigation canals for the CASECNAN irrigation system, as shown by the decline in crop area. The increasing scarcity of farmland is expected to lead to impoverishment in the CLV. However, this did not happen because of the spread of modern rice technology and increased employment opportunities in the nonfarm sector as local towns, small cities, and big cities develop further and become more accessible to the villagers.

TABLE 3. Indicators of population pressure in the Central Luzon Village, 1977-2013

Item		1977	1992	2004	2013
Size of the village (ha)	[A]	301	301	301	301
Crop area (ha)	[B]	301	250	242	210
Total population	[C]	649	1110	2292	2925
Total no. of households	[D]	118	230	381	509
Total no. of farmers' households	[E]	88	134	129	142
Population density (man/land ratio)	[F]	2.2	3.7	7.6	9.7
Population pressure over the land					
a. Land/family ratio	[A/D]	2.6	1.3	0.8	0.6
b. Land/farmer hh ratio	[A/E]	3.4	2.2	2.3	2.1
c. Land/person	[A/C]	0.5	0.3	0.1	0.1

Hayami and Ruttan [1985] pointed out that population pressure induces the spread of land-saving technology (or seed-fertilizer technology). The GR started in the Philippines in 1966 with the release of the first modern variety (MV) of rice (IR8) by IRRI. As early as 1977, the adoption ratio of MVs was close to 100 percent. The proportion of farmers using fertilizer rose from 60 percent in the wet season of 1977 to nearly 100 percent in 1992. The proportion of those using pesticides rose from 1977 to 1992 but then dropped in 2004 and 2013, presumably because of the spread of the integrated pest management technology that decreases the use of pesticides. The proportion of farmers using mechanical technology such as tractors and threshers rose continuously from 1977 to 2013 because of increases in wages that induced farmers to substitute machines for labor to minimize labor costs. The rapid spread of modern seeds and mechanical technology suggests that the CLV was a frontrunner in the adoption of modern rice technology (Table 4).

TABLE 4. Adoption of modern rice technology in the Central Luzon Village, 1977-2013

	1977		1992	2004	2013	
	Wet	Dry	All seasons	All seasons	Wet	Dry
No. of observations	83	43	131	129	140	134
% of modern rice users	98	100	93	96	99	98
% of fertilizer users	60	88	99	NA	97	96
% of pesticide users ¹	71	74	95	73	74	78
% of tractor users	34	30	52	100	76	79
% of threshing machine users	49	100	94	98	95	95

* Chemical herbicides and insecticides.

* NA – not available

As a result of the adoption of MVs, yield rose from four tons per hectare in 1985 to 6.1 in 2013. Because of the development of the irrigation system from groundwater extraction (called in the CLV as deep water pump) in the mid-1990s to gravity system in the late 2000s, rice cropping intensity index (or the number of rice crops per unit of land per year) rose from about one per year in 1985 (when the village was rainfed) to nearly two per year in 2013 (when CASECNAN irrigation services reached the village). MV technology is labor-using because it needs greater labor input in crop care activities such as fertilizer and pesticide application and weeding as well as in harvesting and threshing due to the higher yield. Moreover, the increase in cropping intensity entails more labor input per unit of land every year. The increase in cropping intensity brought about by the availability of irrigation and the use of MVs with a shorter growing period enabled the farmer to use the same piece of land more than once every year—during the late monsoon season in November in the case of rainfed farms and during the dry season in the case of irrigated farms.

The spread of new rice technology increased labor employment opportunities in the CLV, which is beneficial to the landless poor whose main source of income is daily wage work in rice farming. The increasing availability of income-earning opportunities in rice farming attracted in-migrants from neighboring villages that partially contributed to the burgeoning number of landless households in the CLV (Table 1). While the new rice technology confers economic gains to both the landless poor and the farmer households, much of the gains accrue to the farmer households. For the farmer households, gains in the new rice technology come from higher yield and greater production per unit of land per year due to higher cropping intensity. Factor-share analysis in rice farming in the CLV shows that a higher proportion of gross output goes to land (33 percent compared with 26 percent for labor), indicating that substantial gains from the new rice technology accrue to the owner of the land (i.e., farmer households) compared with the owner of labor (i.e., landless laborer) [David and Otsuka 1994:100].

3.2 Land reform

The *hacienda* system was prevalent in Central Luzon and almost all farmers were share tenants in the region before the implementation of land reform in 1972. The major purpose of the land reform program is to transfer land to the actual cultivators (land-to-the-tiller) and promote leasehold tenancy (operation leasehold) in place of share tenancy. The land ceiling was seven hectares and share tenants whose landlord owned more than seven hectares were converted to amortizing owners and eventually to full owners after paying amortization fees to the Land Bank of the Philippines for 15 years (land-to-the-tiller program). Share tenants whose landlord owned less than seven hectares were converted to leaseholders (operation leasehold program). Amortization fees and leasehold rent were fixed by law at a rate below the market return to land so that there were sizable gains in returns to land that accrue to the former share tenants. The land reform was most effectively implemented in favorable rice-growing areas, including Central Luzon [Otsuka 1991]. As a result, there was a high incidence of owner cultivators and leaseholders in the CLV in 1992, and that there has been no single remaining share tenant in the CLV since 1992.

There was a modest increase in the incidence of mortgaging (or land pawning) over time (Table 5), which was rare in the CLV in the distant past. The borrower pawns out the land to a lender while surrendering her/his cultivation rights to the land in exchange for a loan. The land comes under the control of the lender, who may decide to become the tiller of the land or otherwise hire a *porcientuhan* worker. The borrower keeps the land until such time that the borrower is able to pay back the loan. While the transfer of cultivation right to the third person is deemed illegal by law, the landowner does not care as to who cultivates the land as long as land rent is paid. According to Nagarajan, Quisumbing, and Otsuka [1991], pawning arrangements evolved more commonly among leasehold lands because economic rents were created by the land reform law. Such rents are equal to the divergence between market returns to land (proxied by share tenancy rents) and leasehold rent fixed by the land reform law, which creates a positive transaction value to leasehold rights.

Another important change in the agrarian structure in the CLV is the emergence of *porcientuhan* contract, which did not exist in 1977 and 1992, but appears to have become common in 2004 and 2012. The proportion of rice area under *porcientuhan* contract rose from nil in 1992 to more than 50 percent in 2004 and 2013 (Table 5). As early as the 1990s, Hayami and Otsuka [1993] observed the emergence of a type of labor contract (*kasugpong* or *porcientuhan*) in the Central Luzon region of the Philippines. Under this contract, the *porcientuhan* worker supplies labor for the share of gross output at 10 percent, while the landlord takes care of all the costs, including the wages of casual labor employed in peak seasons.

TABLE 5. Tenure of cultivated plots of households in the Central Luzon Village, 1992 to 2013

	1992		2004		2013	
	Parcels	Area	Parcels	Area	Parcels	Area
Owned	82 (44)	93 (37)	103 (46)	98 (29)	94 (42)	54 (26)
Leased	79 (42)	128 (51)	19 (8)	24 (7)	29 (13)	24 (11)
Mortgaged	15 (8)	18 (7)	18 (8)	28 (8)	16 (7)	13 (6)
Borrowed	9 (5)	9 (4)	11 (5)	12 (4)	5 (2)	11 (2)
Shared-tenant	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Others	3 (2)	3 (1)	0 (0)	0 (0)	5 (2)	2 (1)
<i>Porcientuhan</i>	0 (0)	0 (0)	73 (33)	180 (53)	75 (33)	108 (51)
Total	188 (100)	250 (100)	224 (100)	342 (100)	224 (100)	210 (100)

Note: Numbers in parenthesis are proportions to total.

Table 6 provides some characteristics of the *porcientuhan* households. It is interesting to note that, in spite of the increase in the number of *porcientuhan* households from 58 in 2004 to 77 in 2013, some socioeconomic characteristics of *porcientuhan* households remained the same. The average size of a *porcientuhan* household was around five persons in a household in 2004, and this has remained unchanged in 2013. The proportion that had electricity slightly increased from 76 percent in 2004 to 79 percent in 2013, while households that have access to sanitary toilet facilities remained unchanged between 2004 and 2013 at 86 percent.

Heads of *porcientuhan* households have, on average, 12 years of schooling in 2004 and seven years of schooling in 2013. This indicates that the more educated *porcientuhan* workers (those with more than primary schooling) have retreated from *porcientuhan* work to other jobs that are presumably better paying. A cursory check of the data for 2013 indicates that *porcientuhan* workers have relatively the same level of education as agricultural landless workers (about seven years). Farmers, on the other hand, have a relatively higher level of education (nine years), while non-agricultural workers have eight years, on average. In terms of age, the heads of *porcientuhan* households have become considerably younger. In 2004, the average age of *porcientuhan* households was 50 years old, while in 2013, it was 42. It seems that, in more recent years, the *porcientuhan* workers are the young and less educated people who have few employment opportunities outside rice farming.

In terms of relationship to the landlord, most of the *porcientuhan* household heads (63 percent in 2004; 62 percent in 2013) were not related to their landlord. In 2004, those who are directly related to the household head comprised only seven percent of *porcientuhan* workers, while the proportion of those who are distantly related to the household head was at 30 percent. No significant change in the proportions was observed in 2013.

TABLE 6. Socioeconomic characteristics of *porcientuhan* households in the Central Luzon Village, 2004 and 2013

	2004		2013	
No. of households	57		77	
Average household size (no. of members)	5		5	
Education of household head (yr)	12		7	
Age of household head (yr)	50		42	
Proportion with electricity	76		79	
Proportion with sanitary toilet	86		86	
Relation to landlord (%)				
Direct relative	7		6	
Distant relative	30		32	
Not related	63		62	
Average POR share (%)	10		10	
Average size of POR land (ha)	2		2	
Residence of landlord (%)				
Within CLV	42		34	
Outside CLV but in the city	44		54	
Outside NE	14		12	
Farm income (PPP US\$)*	187	(6)	1,873	(35)
Non-farm income (PPP US\$)	2,497	(85)	3,268	(61)
Remittances (PPP US\$)	243	(8)	225	(4)
Total income (PPP US\$)	2,927	(100)	5,366	(100)

* Numbers in parenthesis are proportions to total income.

Hayami and Otsuka [1993] attributed the proliferation of *porcientuhan* to the implementation of land reform, the development of new rice technology, withdrawal from farming, and the transfer of land cultivation to urban residents. The emergence of the *porcientuhan* contract is most importantly attributed to the implementation of the land reform law that made sharecropping illegal. If share tenancy is not illegal, landlords could have opted to hire a share tenant because share tenancy has a built-in labor incentive mechanism in the presence of costly labor supervision of a *porcientuhan* worker. Share tenants receive 50 percent of the gross output, whereas *porcientuhan* workers receive only 10 percent. The work incentive mechanism is thus stronger under a share tenancy contract. Because

the *porcientuhan* workers are inefficient (they do not exert optimal effort), there has been frequent hiring and firing of *porcientuhan* workers and their contract commonly lasts for only about three to four cropping seasons (about two years).

The *porcientuhan* contract is commonly observed only in irrigated areas in Central Luzon, but not in rainfed areas. As mentioned above, the *porcientuhan* contract was first documented in the CLV in the 2004 survey. In the early 2000s, the irrigation system started to develop in the village with the introduction of deep well water pumps for groundwater extraction. Thus, the rising incidence of *porcientuhan* in the CLV could be explained by the increase in productivity of agricultural land brought about by the access to irrigation first through groundwater extraction and, more decisively, by the opening of the CASECNAN national irrigation system in 2008. Moreover, the released rice varieties from 2004 and 2013 incorporated better traits such as high yield capacity, resistance to multiple pests and diseases, shorter growth duration, and better grain quality. Rice with better grain quality tends to command a higher price in the market.

The *porcientuhan* arrangement was also seen as an “institutional innovation” that caters to the demand of land-reform beneficiaries in the CLV who want to withdraw from working on the farms while at the same time holding on to their land ownership titles or leasehold rights. The *porcientuhan* contract is an imperfect substitute to a tenancy contract while it can be claimed as a labor-employment contract [Hayami and Otsuka 1993:156], which is legal under the land reform law.

The rising incidence of *porcientuhan* workers is partly because of the rising incidence of land sales to people living outside the CLV, either within the municipality or even farther outside the province. The proportion of *porcientuhan* workers reporting their landlords as living outside the CLV rose from 58 percent in 2004 to 66 percent in 2013, while the proportion of those whose landlords live within the CLV declined from 42 percent to 34 percent. As these outside residents could not possibly farm the land, they would resort to a *porcientuhan* contract. We were able to document a rise in the incidence of land sale from seven parcels in 2004 to 19 parcels in 2013. The three most common reasons for land sale in 2013 were consumption expenditure, debt repayment, and medical expenses (or distress sale) (40 percent of sold parcels); production expenses (33 percent); and education (10 percent).

An important inquiry is why the *porcientuhan* contract became popular among the landless agricultural workers. The bottom panel of Table 6 indicates that there has been a drastic improvement in total farm income obtained by the *porcientuhan* households. From around \$187 PPP 2005 in 2004, the average annual farm income in 2013 has increased tenfold to about \$1,873 PPP 2005. This is largely because of the emergence of double cropping in the CLV due to CASECNAN and the rise in rice prices since the Asian food crises in 2006-2008. Nonfarm income has also increased from 2004 to 2013, albeit only slightly, while remittances have

slightly declined. Overall, technical change in terms of irrigation and rise in rice prices has improved the income status of *porcientuhan* households, making the *porcientuhan* contract an attractive alternative to casual daily work in agriculture and low-level nonfarm jobs.

Urbanization may have also resulted in the proliferation of *porcientuhan* contracts. Table 6 also shows the location of the residences of landlords for whom the *porcientuhan* workers work. Hayami and Otsuka [1993] observed that these urban dwellers have a relatively high cost of monitoring daily farm workers so they resort to the *porcientuhan* arrangement because share tenancy is prohibited by law. As mentioned earlier, some of the urban dwellers who hired *porcientuhan* workers are recipients of pawned-out farmland who could not cultivate the land themselves, thus resorting to a *porcientuhan* contract.

To sum up, we have presented changes in agrarian structure in the CLV from 1992 to 2013, highlighting the predominance of owner cultivators as a result of the land-to-the-tiller program, the modest incidence of mortgaging arrangements, and, importantly, the rising incidence of *porcientuhan* contracts. The immediate cause of the emergence of *porcientuhan* contracts was the land reform regulation that made the land rental market inactive by making share tenancy illegal, subsequently removing the opportunity for the landless agricultural workers to rent land for their own cultivation. Under a perfectly competitive land market, share tenancy will be chosen over *porcientuhan* contract because share tenancy provides an effective incentive mechanism in the presence of costly labor supervision of *porcientuhan* workers. As we shall show later, despite the prohibition of share tenancy (“demise of the agricultural ladder”), the lot of landless workers did not deteriorate because of the increased employment opportunities in rice farming brought about by the new rice technology and retreat of the more well-to-do farmers from farm work, and, more decisively, because of the increased employment opportunities in the booming nonfarm sector.

3.3 Infrastructure development

Market infrastructure: It refers to roads and a bridge in the CLV. The CLV is located about four kilometers of the city proper, which is in turn just one kilometers from the Pan-Philippine National highway that traverses the middle of the city from north to south. In the middle of the CLV is a provincial road that connects the city to the nearby municipality. Just below the village boundary is a national highway called the Nueva Ecija-Pangasinan highway that connects the two provinces. The CLV is a commuting distance from a state university and a rice research institute (both located within the city) and even to the more urbanized San Jose City to the north and Cabanatuan City to the south. Within the CLV, the main streets are cemented and farm-to-market roads are cleared and paved with gravel. It is clear the CLV is strategically located to have fairly good access to urban labor markets and new rice technology.

In the first survey in 1977, the CLV has no bridge, making it isolated from the city proper. By the mid-1990s, a concrete bridge crossing the Baliwag River bordering the village from the west was constructed. This reduced the transport cost of residents and their goods. Importantly, the new bridge enabled young children to complete a full six years of primary schooling and even attend secondary and tertiary schools located outside the CLV. In earlier years, the single primary school within the CLV offered only four years of primary schooling, which is two years less than the compulsory six years to complete primary schooling.

While there was no data on access to electricity in 1977 and 1992, we found that about 85 percent of households had access to electricity in 2003 and 2014. Electricity is important in the development of small- and medium-scale enterprises and a time-saving infrastructure that releases time of women away from domestic work to market work. For young girls, it releases them of responsibility at home after school, thereby allowing them to attend schools and spend more time studying after class.

It is important to mention that improvement in the supply of public goods in the CLV has been facilitated by the passage of the Local Government Code in 1992, which significantly increased the internal revenue allocations from the national government to the local governments. This bill was intended to provide greater funding for village-specific needs, including those related to market and social infrastructure (e.g., school buildings, clinics, etc.). In addition to this, there has been an increase in the leadership competency of local mayors (equipped with engineering and doctoral degrees) since the early 1990s, which resulted in greater local revenue collections and internal revenue allocations and other improvements in local governance, including its early computerization of real estate tax collections.

Irrigation: In the late 1970s, most of the farmlands in the CLV were rain-fed farms, while a few farms were able to use groundwater pumps for irrigation during the dry season [Dozina, 1978]. By 1992, the CLV became partially irrigated by deep well pumps and, by 2013, the CLV is almost fully irrigated by the CASECNAN irrigation system. Table 7 shows that 47 percent of its rice area was irrigated by pumps in 1992 and 88 percent by the gravity irrigation system in 2013. It is important to mention that the rental market for water pumps evolved in the early 1990s to mid-2000s in response to the rising demand for irrigation water in rice production and, importantly, in the production of high-value crops such shallots and watermelon. In fact, based on our own recollection during the previous surveys, there were a few large farmers who owned water pumps and rented them out to other farmers as an additional source of household income. The development of irrigation systems in the CLV has become one important driver of household income growth from rice production through double cropping and through diversification to the production of high-value crops (the so-called high-value revolution).

TABLE 7: Area irrigated, by source, in the Central Luzon Village, 1992-2013

Source of irrigation	1992	2004	2013
National irrigation system (ha)	0 (0%)	0 (0%)	184 (88%)
Underground water extraction (ha)	117 (47%)	153 (63%)	3 (1%)
Rainfed (ha)	133 (53%)	89 (37%)	23 (11%)
Total rice area (ha)	250 (100%)	242 (100%)	210 (100%)

3.4 Growing urban influences

Rapid urbanization is occurring within the vicinity of the CLV. Rapid urbanization means the rapid rise in the population of the neighboring cities surrounding CLV, particularly, Cabanatuan, San Jose, and the Science City of Muñoz (Figure 1). The rapidly increasing population growth and development of urban cities near the CLV may be drawing the people living in the CLV to engage in nonfarm work in the nearby cities. Households who rely on agriculture income (i.e., farmers) tend to live in the area of the village that is far from the urban areas, whereas non-agricultural households, daily wage worker households, and *porcientuhan* households tend to live near the urban area. These three groups of households depend on nonfarm livelihood for their income, either for a large portion of it (as in the case of non-agricultural households) or a small part of it (as in the case of the households of daily wage and *porcientuhan* workers). Living within easy access to the urban area reduces the transaction cost of earning a living.

3.5 Human capital

Accumulation of human capital in terms of education and migration is an important pathway out of poverty. In the CLV, we notice an improvement in schooling attainment of its population as reflected by the distribution of the population by educational attainment (Table 8).

TABLE 8: Distribution of population, by educational attainment, in Central Luzon Village, 1977-2013

Educational level	1977		1992		2004		2013	
	No.	%	No.	%	No.	%	No.	%
1. Non-schooling age	112	17.3	198	17.8	285	12.4	341	11.7
2. No education	43	6.6	21	1.9	67	2.9	72	2.5
3. Primary level (unfinished)	151	23.3	291	26.2	348	15.2	900*	30.8
4. Primary level (completed)	198	30.5	243	21.9	451	19.7		
5. High school (unfinished)	64	9.9	148	13.3	339	14.8	412	14.1
6. High school (completed)	57	8.8	135	12.2	477	20.8	727	24.9
7. College (unfinished)	18	2.8	45	4.1	171	7.5	276	9.4
8. College(completed)	6	0.9	29	2.6	154	6.7	197	6.7
Total	649	100.0	1110	100	2292	100.0	2925	100.0

* Includes primary (unfinished) and primary (completed).

The share of the population with no education has decreased from 6.6 percent in 1977 to only 2.5 percent in 2013 (Table 8). Similarly, the proportion of the population with limited education (primary [unfinished] and primary [completed]) has decreased from a combined total of about 53.8 percent in 1977 to just about 30.8 percent in 2013. This is because of the upgrade of the primary school in the village, which went from a school that only reached grade 4 to grade 6 (full years of primary school). Despite the CLV not having a high school within the village, the proportion of the high school-educated population (unfinished and graduate combined) has more than doubled from 18.7 percent to 39.0 percent in 2013. We presume that this is partly because of the construction of the bridge that connects the CLV with city proper, where high schools are located, and partly because of the rise in household income that gave households the ability to pay the out-of-pocket cost of high school education. Republic Act (RA) 6655 “free public secondary education act” of 1988 is another contributory factor to the rise in the number of people with high school education.

The number of people in the CLV with a college education in 1977 was only 24 (3.7 percent of the total village population), but this has sharply increased to 74 people in 1992 (6.7 percent). Then, it further increased to 325 people in 2004 (14.2 percent) and further to 473 people in 2013 (16.1 percent). Obviously, there was a rising trend in parental investment in college schooling even though the parents have to pay higher out-of-pocket costs consisting of school fees and board and lodging for those schools that are not within commuting distance to the CLV.

The improvement in human capital is also supported by Table 2 from which it can be inferred that an increasing number of household heads are able to engage in work in the nonfarm sector. These heads are commonly the more educated members of the community. The proportion of households headed by non-agricultural workers rose from 13 percent in 1977 to 40 percent in 2013. Such shift in occupational choice of household heads could have been facilitated by the rise in schooling attainment of people in the CLV and the increase in demand for the more educated laborers in the nonfarm sector in local towns and cities that are easily accessible from the CLV.

An increase in schooling attainment of the younger generation could be attributed to three factors: (1) increased household income, (2) rising returns to schooling, and (3) declining cost of schooling borne by parents. The latest was facilitated by the free primary education since the American colonial era and by the free secondary public schooling in 1988. Rising household income can be attributed to the increasing profitability of rice farming due to the expansion of the irrigation system and partly due to favorable rice prices that continued on since the rice crises in 2006-08. High-value revolution in terms of high-value crops and livestock production appears to have started in the CLV before the opening of the CASECNAN irrigation system, but then it appears to have declined because rice farming with double cropping became more profitable than the cultivation of

high-value crops. Nonfarm employment opportunities in the government sector, nearby research centers and universities, and, importantly, in the retail trade, transport, construction, and communication sector, have started to evolve in the CLV, leading to higher nonfarm income and higher total household income.

Following the literature, we consider migration as an investment in human capital. Because of the strategic location of the CLV and its accessibility to local towns and small cities and, to some extent, even to Metro Manila, we notice frequent seasonal outmigration of landless male casual daily wage workers to work on construction projects outside the CLV during the slack agricultural period. Women also migrate but mostly for domestic work. The younger generation belonging to the landless households has a higher tendency to migrate locally and even overseas [Estudillo et al. 2014]. Given the importance of migration, remittances have become an important source of income, particularly among landless households as will be discussed below.

4. Changing sources of livelihood and poverty

The preceding sections have presented the evolution of modernizing forces that greatly affected the economic and social fabric of the CLV. We then proceed to the analysis of processes by which the evolution of the four modernizing forces has affected the level and distribution of income as well as poverty in the CLV.

4.1 Changes in household income structure

Table 9 shows a snapshot of the average income of farmers and landless workers in the CLV from 1997 to 2013 when income data are available. We classify income into three major classifications: farm income, non-farm income, and remittances.

Farm income includes wages earned from working on the farm and net income from rice, other crops, and livestock and poultry. Wage earnings include income earned by being hired as farm laborers for farm tasks such as land preparation, transplanting, weeding, harvesting, and threshing. Farm income includes the imputed value of owner-produced agricultural goods such as rice, fruits and vegetables, and poultry and livestock products. Households are also able to earn income from non-farm enterprises, which include net income from sari-sari stores and other retail trade, tricycle driving, and ownership of other businesses including cottage industries. Non-farm wage earnings are being derived from working in the formal sector as being employees of the government and private entities and working in informal non-agricultural enterprises. Remittances are income (both in cash and in-kind) that was sent to the household by someone who is away from the household. The value of remittances in kind was imputed by the respondent and added to the total income of the household. Household income in Table 9 is shown in terms of US\$ PPP in 2005.

Average income of farmer households rose from \$670 in 1977 to \$3,126 in 1992 to \$8,151 in 2004 to \$15,128 in 2013. For landless households, household income rose from \$499 in 1977 to \$1,703 in 1992 to \$4,878 in 2004 to \$7,341 in 2013. It is noticeable that in a span of only 9 years from 2004 to 2013, farmer household income rose by 1.8 times and that of landless households by 1.5 times. It was in 2004 and 2013 when household income rose more markedly. For both farmer and landless households, nonfarm income was the major contributor to the rise in total household income. Farm income (largely from rice) and remittances mainly coming from members living outside the village contributed modestly to the rise in total household income. The ratio of farmer household income to landless household income rose from 1.34 in 1977 to 2.06 in 2013, indicating a deterioration in income inequality in the village. This is mainly because of the in-migration of poorer households from other villages to the CLV, attracted mainly by the growing employment opportunities in this newly irrigated village.

TABLE 9. Sources of household income (PPP in 2005) in Central Luzon Village, 1977-2013

Source	1977		1992		2004		2013	
	Farmers	Landless	Farmers	Landless	Farmers	Landless	Farmers	Landless
1. Farm income	398 (59)	241 (48)	1,774 (57)	717 (42)	2,229 (27)	342 (7)	3,856 (25)	598 (8)
1.1 Wage ^a	56 (8)	196 (39)	194 (6)	578 (34)			392 (3)	508 (7)
1.2 Rice	224 (33)	0 (0)	1,186 (38)	0 (0)	1,482 (18)	0 (0)	2,682 (18)	0 (0)
1.3 Other crops	118 (18)	45 (9)	196 (6)	76 (4)	747 (9)	342 (7)	127 (1)	28 (0)
1.4 Livestock			198 (6)	63 (4)			656 (4)	62 (1)
2. Non-farm income	271 (41)	259 (52)	1,071 (34)	553 (32)	5,191 (64)	3,919 (80)	9,638 (64)	5,629 (77)
2.1 Non-farm wage	158 (24)	207 (41)	618 (20)	236 (14)			5,713 (38)	3,263 (44)
2.2 Non-farm enterprises	114 (17)	52 (10)	453 (14)	317 (19)			3,925 (26)	2,367 (32)
3. Remittances	0 (0)	0 (0)	281 (9)	433 (25)	731 (9)	617 (13)	1,634 (11)	1,113 (15)
Total	670 (100)	499 (100)	3,126 (100)	1,703 (100)	8,151 (100)	4,878 (100)	15,128 (100)	7,341 (100)

* Data for wages in 2004 included in Rice and other crops

Note: Numbers in parenthesis are shares to total.

For both the farmer and landless groups, the share of farm income has been steadily declining over time, while the share of nonfarm income has sharply risen sometime after the conduct of the 1992 survey (Table 9). Over time, the share of non-rice income has also declined mainly because of the increasing profitability

of rice production due to double cropping. As the share of farm income decreases across time for both farmers and landless workers, the share of nonfarm income increases. Landless workers in 2013 have more than three-quarters of their total income coming from nonfarm income, indicating that nonfarm work is more lucrative for this group whose main asset is their labor. For farmers, the proportion is about two-thirds.

For the landless households, the share of remittances to total income has sharply increased from 0 percent in 1977 to 25 percent in 1992. Part of the increase may be attributed to the fact that, in the 1980s, Filipinos started to explore job opportunities overseas such as the Middle East and East Asia. Landless people are more likely to migrate outside the village, even for overseas. In 2004, the share of remittances to total income was only 13 percent for landless households, which slightly increased in 2013 to 15 percent. Remittances have also become a major source of income for farming households. In 1992 and 2004, the share of remittances to total income for farmers was around 9 percent, but this has increased slightly to 11 percent in 2013 (Table 9). Because farmers are able to earn from agricultural production (e.g., rice), the decision to migrate outside of the CLV is a less important option compared with the landless workers.

So, how do the four modernizing forces affect the growth of household income? The spread of new rice technology such as the adoption of newer MVs with better characteristics (e.g., resistance against pests and diseases and shorter growing period) as well as the expansion of irrigation that made double cropping of rice possible were instrumental in increasing rice income for farmer households. For the landless, the greater requirement for labor in harvesting and threshing and the retreat of well-off land reform beneficiaries from farm work led to the increase in hired labor demand in rice farming. The profitability of rice farming had been affected by infrastructure development, importantly, irrigation system and the construction of roads and bridge that enabled farmers to market their rice.

The growth of nonfarm income took place because of the increased availability of jobs in local towns, small cities, big cities, and overseas. Urbanization and globalization are the main underlying forces behind the increasing availability of jobs to the CLV people. The growth of cities surrounding the CLV and globalization through offshoring and outsourcing operations created employment opportunities in the local economy that tend to substitute for jobs in rice farming. The growth of the informal sector within the village was also evident, as shown by the rise in income from non-farm self-employment enterprises. Meanwhile, remittance income rose because overseas jobs became more accessible. Placement fees for overseas jobs declined because of the greater competition among labor recruiters, most of them based in Metro Manila. The improvement of human capital in the CLV also qualified them for overseas jobs, thanks to the construction of village schools that gave full primary schooling and the bridge that connects the CLV to the poblacion where high schools are located and to the cities where colleges are based.

4.2 Decomposition of poverty

In this section, we identify the pathways out of poverty by looking at the poverty indicators and decomposing these according to subgroups of the population. Foster-Greer-Thorbecke [$FGT(a)$] indicators were calculated for the CLV using the PPP \$1.25/day poverty². For the years 2004 and 2013, where a more detailed group of households was available, the $FGT(a)$ indicators were also decomposed according to the type of household in order to identify the contributions of the household types to total poverty in the CLV.

The Stata[®] command devised by Jenkins [2006] additively decomposes each $FGT(a)$ index using Equation 1:

$$FGT(a) = \sum_k v_k FGT_k(a) \quad (1)$$

where $v_k = (N_k / N)$ is the number of households in subgroup k divided by the weighted total number of persons (i.e., subgroup population share), and $FGT_k(a)$ is the $FGT(a)$ indicator for subgroup k . Subgroup decomposition shares (S_k), for each k , are also calculated using the following formula:

$$S_k = v_k \left[\frac{FGT_k(a)}{FGT(a)} \right] \quad (2)$$

The poverty indices and their corresponding decompositions are presented in Table 10. In 1992, the overall poverty headcount was at 55 percent and this decreased to 50 percent in 2004, only to increase slightly to 52 percent in 2013. In general, a declining trend in the headcount ratio can be observed despite the slight increase in 2013.

The values of the poverty gap index and the squared poverty gap index decreased from 1992 to 2004, but they increased again from 2004 to 2013, eroding the gains from 1992 to 2004. While there have been improvements in reducing the number of poor people in the CLV, the income needed to move the poorest of the poor out of poverty may have increased over time, i.e., the poor have become poorer.

The headcount for farmers has steadily decreased from 48 percent in 1992 to 44 percent in 2004 to 38 percent in 2013. Similarly, the contribution of farmers to overall poverty has been steadily decreasing due to the rise in farmers' income and the declining share of farming households in the population. In 1992, the farmers' contribution to the overall poverty headcount was at 53 percent; it decreased to 30 percent in 2004 and further declined to 20 percent in 2013.

² Using the PPP conversion factor in 2005 and the Philippine CPI, the following poverty lines were calculated for the CLV: ₱5175 for 1992, ₱10321 for 2004, and ₱15,539 for 2013. Depending on the value of a , $FGT(a)$ indices are defined as headcount ratio ($a=0$), poverty gap ($a=1$), and squared poverty gap ($a=2$).

As for the change in the relative contribution of non-agricultural households to total poverty headcount in 2004, 29 percent of total non-agricultural workers are poor, contributing 16 percent to the total poverty headcount. In 2013, the contribution of non-agricultural workers to poverty headcount drastically increased to 35 percent. The rapid increase is explained not just by the increase in poverty headcount for non-agricultural workers (46 percent in 2013), but also by the sharp increase in the proportion of households engaged in non-agricultural activities from 27 percent to 40 percent (see Table 2).

TABLE 10. Poverty indicators and its decomposition, 1992-2013

1992	Poverty headcount		Poverty gap		Squared poverty gap	
Overall	55		29		19	
Farmers	48	(53)	23	(47)	14	(46)
Landless	65	(47)	38	(53)	25	(54)
2004	Poverty headcount		Poverty gap		Squared poverty gap	
Overall	50		21		12	
Farmers	44	(30)	18	(30)	10	(29)
Non-agricultural	29	(16)	13	(17)	9	(19)
Daily wage workers	66	(32)	31	(36)	18	(36)
<i>Porcientuhan</i>	71	(22)	23	(17)	11	(15)
2013	Poverty headcount		Poverty gap		Squared poverty gap	
Overall	52		29		20	
Farmers	38	(20)	20	(19)	13	(19)
Non-agricultural	46	(35)	24	(33)	16	(33)
Daily wage workers	74	(24)	47	(28)	33	(29)
<i>Porcientuhan</i>	71	(21)	38	(20)	26	(20)

Note: Numbers in parenthesis are subgroup poverty 'share' of each subgroup.

As for the contribution of daily wage workers to total poverty, the poverty headcount ratio increased from 66 percent to 74 percent, but the share to overall headcount ratio has decreased from 32 percent to 24 percent because of the decrease of the share of daily wage workers in the population. The case of the *porcientuhan* households was different in terms of contribution to total poverty, only slightly decreasing despite having no change in *FGT(0)*. It is important to mention that the *porcientuhan* contract offers more remunerative terms and conditions relative to casual daily wage work in rice farming. Thus, it is not surprising that *porcientuhan* workers are economically better off than casual wage workers.

The poverty gap ratio measures the average shortfall of the income of the poor from the poverty line. The poverty gap ratio rose from 2004 to 2013, indicating that the income of the poor went further down from the poverty line. The daily wage worker households have the highest poverty gap ratio, followed by the *porcientuhan* households, while the non-agricultural households have the lowest.

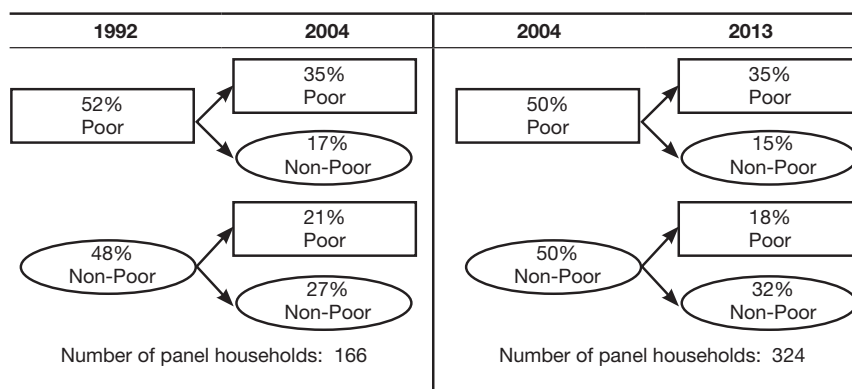
This seems to imply that the poorest of the poor remain in agriculture and that they are the daily wage workers in rice farming. The squared poverty gap ratio measures the inequality of income among the poor and it rose from 2004 to 2013, indicating that the ultra-poor become even poorer in 2013. The highest value of the squared poverty gap ratio was posted by the daily wage worker households, which means that the poorest of the poor indeed belong to this group.

Poverty remains persistent in the CLV in spite of the multifaceted benefits conferred by the modernizing forces. This might be because poor migrants are the ones that settled in the CLV and they provided the additional labor necessary in the booming rice sector. As to whether the benefits of modernizing forces do not trickle down to these poor households need further investigation, although it is clear that these poor new settlers have benefitted from double cropping.

Because the data gathered for the CLV involved complete enumeration of the households, it is possible to create a panel of households from 1992 to 2004 and from 2004 to 2013. Out of the 230 households surveyed in CLV in 1992, 166 were tracked in 2004, whereas out of the 381 households that were surveyed in 2004, 324 were tracked in 2013. Figure 1 illustrates the dynamics of poverty in the CLV for two adjacent survey periods. In 1992, 52 percent of the 166-panel households were considered poor. Of these households, 35 percent remained poor in 2004 (i.e., these households are chronically poor). For the period 2004 to 2013, the chronically poor was close to 35 percent.

In contrast, of those who were non-poor in 1992 (48 percent), 27 percent remained non-poor while the remaining 21 percent fell into poverty. The proportion that fell into poverty in 2004-2013 was 18 percent, which is smaller than the proportion in 1992-2004. Falling into poverty is not a matter of strategy, but a stroke of bad luck (i.e., sickness or death of the major breadwinner, bad harvest, low rice prices, etc.) as nobody would like to fall into poverty. The smaller proportion of those who fell into poverty in the later period is possibly because of favorable rice prices, higher rice yield, double cropping of rice, and more job opportunities in the nonfarm sector.

FIGURE 1. Poverty transition in the Central Luzon Village for adjacent survey years

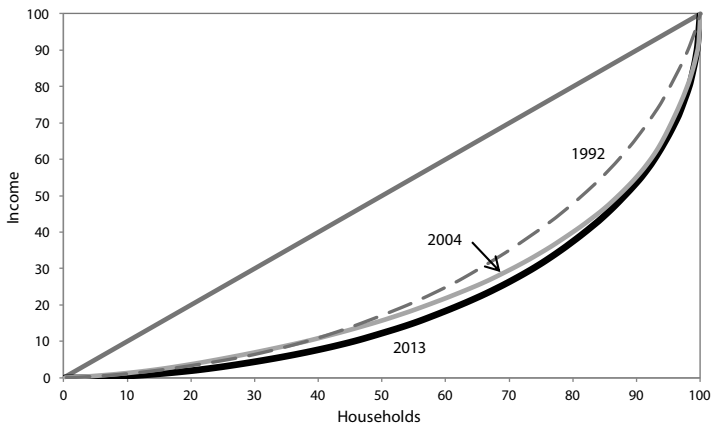


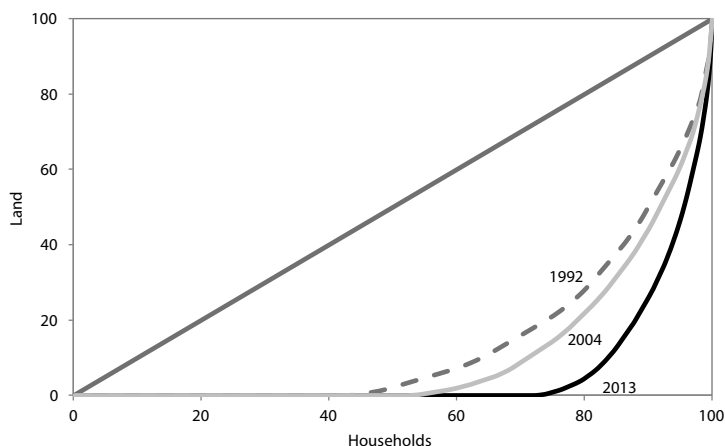
To further support the initial observations from the poverty decomposition, the dynamics of poverty were disaggregated by type of household. Among those who were never poor, farmers and the non-agricultural workers have the two largest shares. They comprise 84 percent of all those who were never poor in 1992-2004 and 91 percent in 2004-13. Similarly, those who moved out of poverty (transient poor) are more likely to be engaged in non-agricultural and farming activities, indicating that rice farming and non-farm activities promote movement out of poverty induced by modern rice technology, infrastructure and telecom development, and improved human capital. Unsurprisingly, a large majority of households who are never poor are farmer households in both 1992-04 and 2004-13, followed by non-agricultural households. Rather unexpectedly, the latter group also comprised a majority of those who fell into poverty in 2004-13 possibly because the nonfarm activities within the CLV are highly heterogeneous and the income derived from these activities rests largely on the economic conditions of the village, which are volatile to seasonal changes in farming.

4.3 Land and income inequality in the CLV

An analysis of the distribution of income and farmland holdings in the CLV may provide insights on which households benefit from the modernizing forces that have been influencing the CLV in the past decades. Figure 2 illustrates the Lorenz curve for income and farmland. For both farmland and income, we see that the distribution of farmland and income in the CLV has always been skewed and has worsened over time. Both Lorenz curves have moved away from the 45-degree line (perfect equality), indicating an increasing trend in inequality from 1992 to 2013. This observation is confirmed by the corresponding Gini coefficients for each Lorenz curve that were calculated and presented in Table 11.

FIGURE 2. Income and land distribution in the Central Luzon Village, 1992-2013





Compared with the income Gini coefficient, the farmland Gini coefficient for 1992 is at 0.7129 representing a high concentration of farmland. The concentration of farmland has continued further in 2004, resulting in an increase in the Gini coefficient to 0.7688. The concentration of farmland has slightly increased in 2013 relative to 2004 mainly because of the increasing scarcity and inequality in access to farmland along with the rapid influx of landless workers. Increased inequality of farmland ownership occurs when some individuals in the CLV have the opportunity to acquire additional parcels of land. Initially starting as a pawned/mortgaged transaction, the original landowners would resort to selling their land/giving up their land rights to the pawnee when owners experience difficulties in repayment. In 2004, the top 10 households with the largest land holdings comprised 28 percent of the total land holdings in that area. In 2013, this proportion further increased to 34 percent. This indicates that fewer households are gaining larger parcels of land while a large number become landless.

TABLE 11. Gini coefficients for land holdings and total income of households in the CLV, 1992-2013

	1992	2004	2013
Income Gini coefficient	0.4842	0.5689	0.6074
95% conf. interval	[0.4482 0.5267]	[0.4998 0.6438]	[0.5636 0.6586]
Land Gini coefficient	0.7129	0.7688	0.8691
95% conf. interval	[0.6458 0.7619]	[0.7329 0.7906]	[0.8394 0.9040]

Migration also has an important impact on the distribution of farmland. As can be seen in the Lorenz curves for farmland (Figure 2, panel B), the proportion of landless members in the CLV has increased sharply. Of the migrant households in 2013, 45 percent were immigrants to the CLV and were engaged in non-farm

work, while 22 percent were immigrants to the CLV and were engaged in daily agricultural wage work. These two groups of migrants represent the largest share of landless households in the CLV.

Relatedly, the influx of migrants to the CLV plays an important role in explaining how non-farm income prevented a drastic deterioration of income distribution in the CLV despite the highly unequal distribution of land. The rapid urbanization occurring within the vicinity of the CLV, as well as the improvements of human capital, has increased the non-farm income-earning opportunities available for landless workers. This weakened the reliance on land as a source of livelihood for most of these households, explaining the slower pace of increase of income inequality compared with farmland inequality.

A decomposition of the Gini coefficient by sources of income (Table 12) was conducted to quantify the relative importance of various income components to overall income inequality. Following the procedure used by Otsuka, Cordova and David [1992] and Feldman [2006], the total income Gini for each year was decomposed into its income components using the formula:

$$G = \sum_i S_i R(y, x_i) G(x_i) \quad (3)$$

where G is the Gini coefficient of total income, $G(x_i)$ is the Gini coefficient for the income from the i th source, S_i is the share of i th source, and $R(y, x_i)$ is the rank correlation. Intuitively, Equation 3 explains the total income inequality, G , as influenced by the relative importance of the income source to the total income, S_i , the distribution of income of source $G(x_i)$ and the relationship between the two, $R(y, x_i)$. Table 12 not only provides the share of the income source to total inequality but also provides the percentage change in inequality induced by a small change in income source.

TABLE 12. Decomposition of total income, by income source

Source	1992			2004			2013		
	Gini	Share	% change	Gini	Share	% change	Gini	Share	% change
Farm income									
Wage	0.6868	1	-0.1298				0.7635	0	-0.0747
Rice	0.7598	29	0.0201	0.8665	8	-0.0013	0.9244	15	0.0231
Other crops	0.8536	5	-0.0083	0.847	8	-0.0001	0.9734	0	-0.0057
Livestock	0.7913	4	-0.0155				0.9788	5	0.0102
Non-farm income				0.5692	62	-0.0376			
Non-farm wage	0.8811	25	0.0657				0.7871	29	-0.0138
Non-farm enterprises	0.8563	16	0.0071				0.9325	10	0.0068
Remittances	0.9366	20	0.0607	0.7902	22	0.039	0.8323	41	0.0541
Total income	0.4842	100		0.5689	100		0.6074	100	

Consistently, across the years, rice income, non-farm income (nonfarm wage and non-farm enterprise), and remittances have the largest shares contributing to total income inequality. Over time, there was a shift in the inequality-reducing sources of income. In 1992, all of the inequality-reducing income sources were related to agriculture (i.e., wage, crop, and livestock). For 2004, non-farm income as a whole reduced inequality. For 2013, farm wages and non-rice production were inequality-reducing sources of farm income, while non-farm wages were inequality-reducing sources of non-farm income. Across the years, the percentage change in the Gini coefficient of total income from a small change in remittances has been increasing, implying that remittances have consistently been inequality-increasing. Overall, the decomposition supports the importance of agricultural wages and non-farm wages as inequality-reducing sources of income, attesting to the rising importance of labor and human capital as a source of household income.

5. Summary and conclusions

The spread of modern rice technology and the infringement of forces of modernization at the core of livelihood of rural Filipino households are suspected to be major causes of impoverishment. This paper is an exploration into the paths of development of a typical rice-growing village in Central Luzon (called the CLV) where new rice technology was successfully adopted and where four forces of modernization have evolved, causing socioeconomic changes in this village. The four forces of modernization are (1) population pressure on the closed land frontier; (2) implementation of land reform; (3) expansion of public infrastructures such as irrigation systems, roads, and schools; and (4) growing urban influences accelerated by improvements in transportation and telecommunication systems.

The main finding is that the interaction between the new rice technology and forces of modernization did not necessarily lead to impoverishment and destitution. On the contrary, evidence from the CLV shows a remarkable increase in household income and no increase in poverty, although income distribution has deteriorated because of the deterioration in farmland distribution and, more decisively, by the influx of poor migrants to the CLV who were attracted by the increase in employment opportunities in rice farming due to the expansion of the irrigation system.

In terms of population pressure, it was found that the man-land ratio has increased over time, indicating a strong population pressure on the closed land frontier. The implementation of land reform led to a major shift in land tenure away from share tenancy (which is prohibited by law) in favor of leasehold tenancy and ownership. Because of the prohibition of share tenancy, a new system of land tenure in the form of mortgaging (or land pawning) has evolved because of the rise in the transaction value of leasehold land. A new form of labor contract called *porcientuhan* became popular when the CLV started to have access to irrigation beginning with deep water pump irrigation and then with the

gravity irrigation system of CASECNAN. The forces of urbanization, manifested in the rise of small cities and the expansion of big cities near the CLV, have started to be felt in the CLV as households who are more dependent on non-farm income (such as the non-agricultural households, farm daily wage workers, and *porcientuhan* workers) tend to live in that part of the CLV that is more accessible to the urban areas. Infrastructure has developed, including market infrastructure (roads and bridges) and, more recently, the irrigation system for rice farms. The human capital of households in the CLV sharply improved, giving villagers better opportunities to access jobs in the booming non-farm sector.

These catalysts of change have affected the sources of income of households in the CLV. Rice income—which has been traditionally a major source of income for farmers—has been replaced by non-farm income. For landless workers, the share of agricultural wage work has been declining, while those of remittances and non-farm wage income have become more important. Both farming and landless households (the poorest in the village) have experienced remarkable improvement in income. This is due to the increase in income from the rice sector due to the development of irrigation, which allowed double-cropping, and because of the increase in income from nonfarm work.

Poverty headcount index has declined over time in the CLV as a whole. Headcount ratio was highest among daily wage workers and *porcientuhan* workers. Farming households and non-agricultural households comprised a substantial portion of households that were never poor and poor households in these groups are more likely to move out of poverty. It attests to the importance of having farmland and being engaged in non-agricultural work as these are important “safety ropes” to move out of poverty.

The modernizing forces also redefined the sources of income inequality. Household incomes that promote equality are agricultural wage and high-value products (or high-value revolution), whereas inequality-promoting are nonfarm enterprises and remittances. Migration to the CLV has increased inequality of land distribution, but the availability of employment opportunities in farm and nonfarm wage work brought about by urbanization and improvement of infrastructure and better human capital prevented a drastic deterioration of income distribution. In the end, land distribution no longer dictates the distribution of income in this village.

To sum up, this village has demonstrated that, contrary to existing belief, the interaction between the new rice technology and the four forces of modernization has, in fact, conferred benefits to a large majority of the villagers. The main pathway is the creation of employment opportunities in rice farming and in the non-farm sector within and outside the village. Since non-farm income is now the main source of income, it seems reasonable to conclude that human capital has become more important than farmland in the pursuit of a livelihood.

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